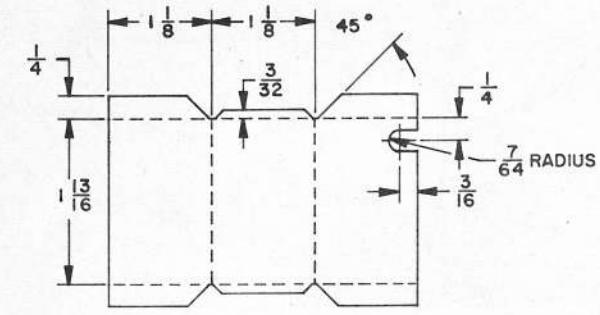
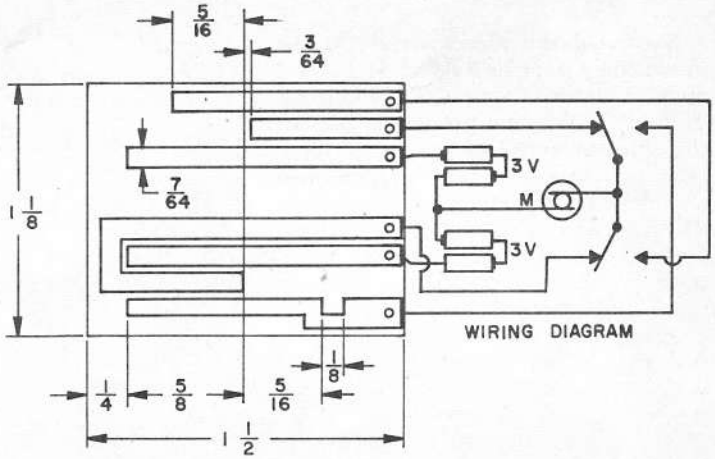
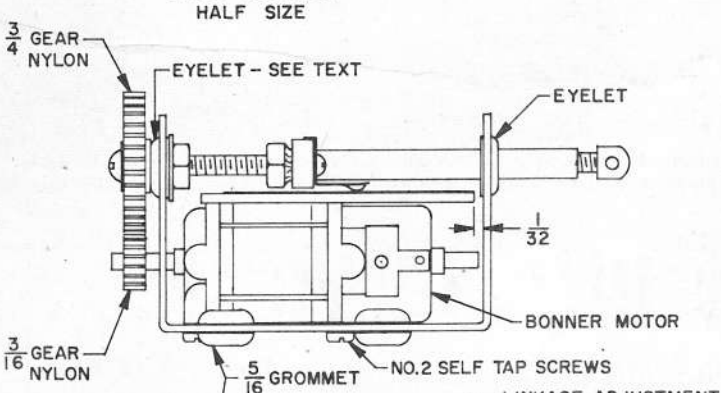


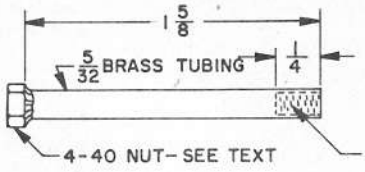
DUST COVER
.020 ALUMINUM
HALF SIZE



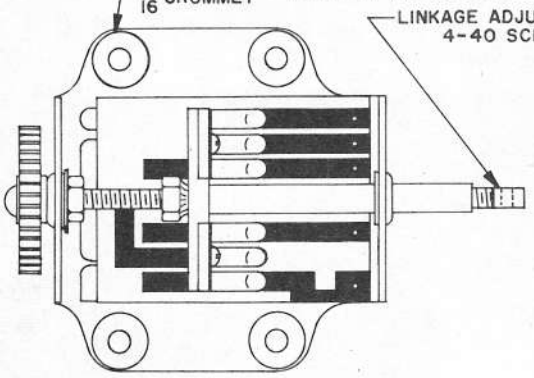
WIRING DIAGRAM

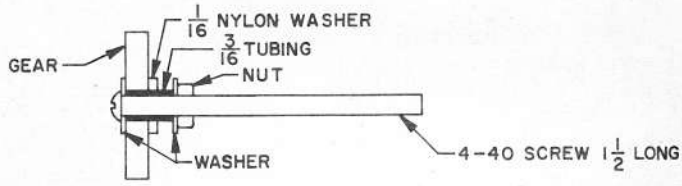
CIRCUIT BOARD — 1/16 THK
NOT TO SCALE
SEE TEXT



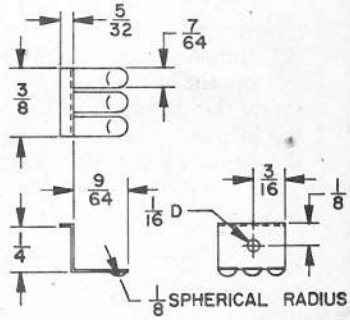


OUTPUT SHAFT

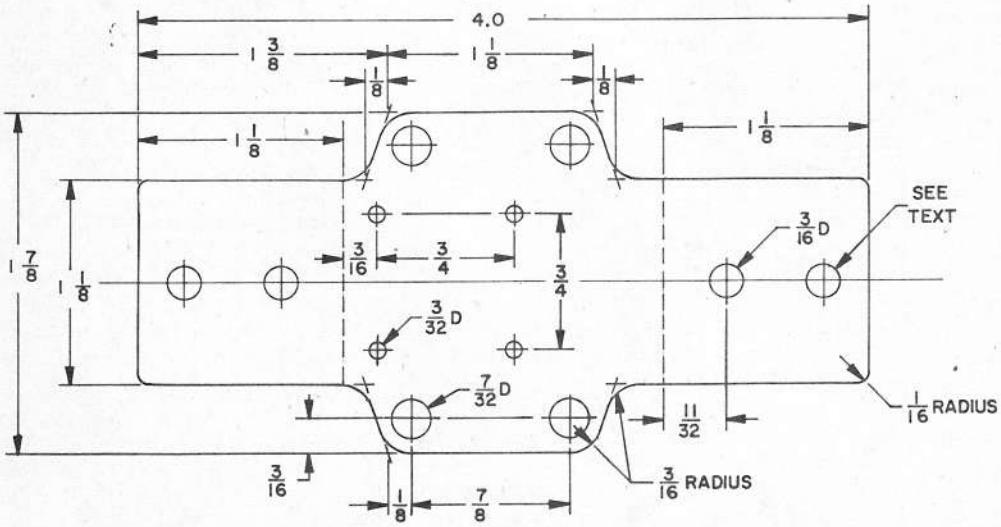




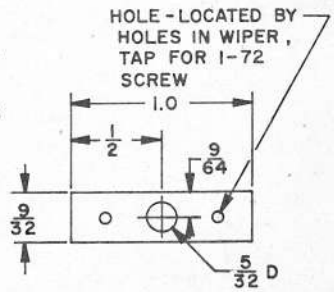
DETAILS OF DRIVE
SCREW & BEARING



WIPER CONTACTS
.006 PHOSPHOR BRONZE



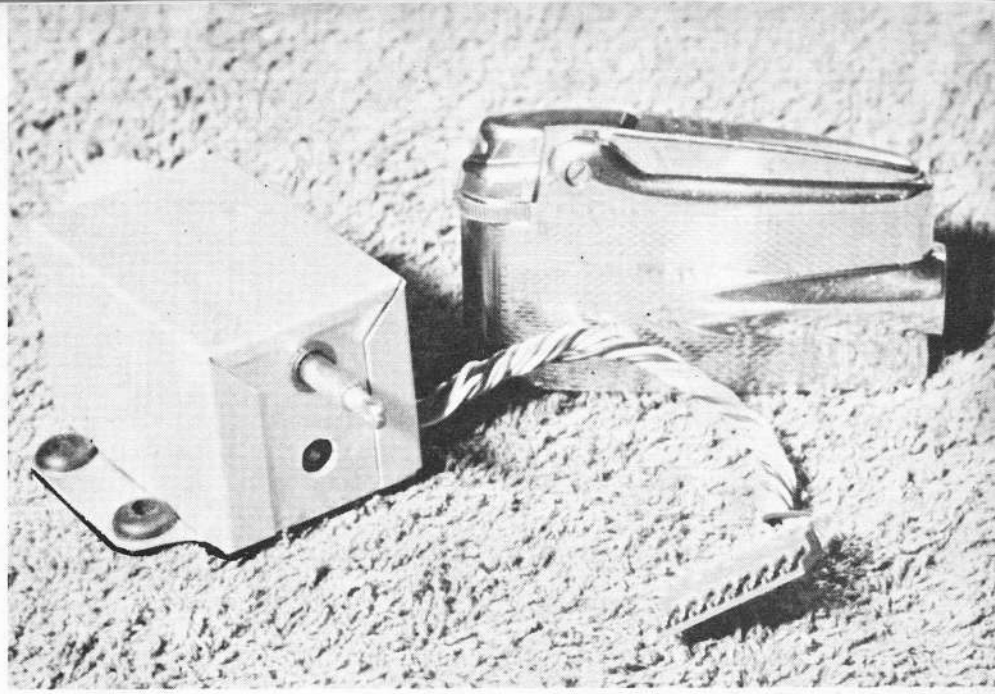
SERVO FRAME — .040
SOFT ALUMINUM



WIPER BAR
1/8 THK PHENOLIC OR PLASTIC

DRAWN BY R.A. KONKLE

by DON BAISDEN AND DICK KONKLE



Best indication of its miniaturization is to compare it for size with propane cigarette lighter in picture. The dust cover is a simple bending process as is the servo mount and base.

Mini Multi Servo

FOR THE MAN WHO ENJOYS MAKING HIS OWN THIS MINI SERVO WILL REALLY FIT THE BILL—FOR THE SHIP THAT HAS A SPACE PROBLEM IT ALSO FITS THE BILL—AND FOR THE TINKERER WHO JUST LIKES TO SEE IT OPERATE.

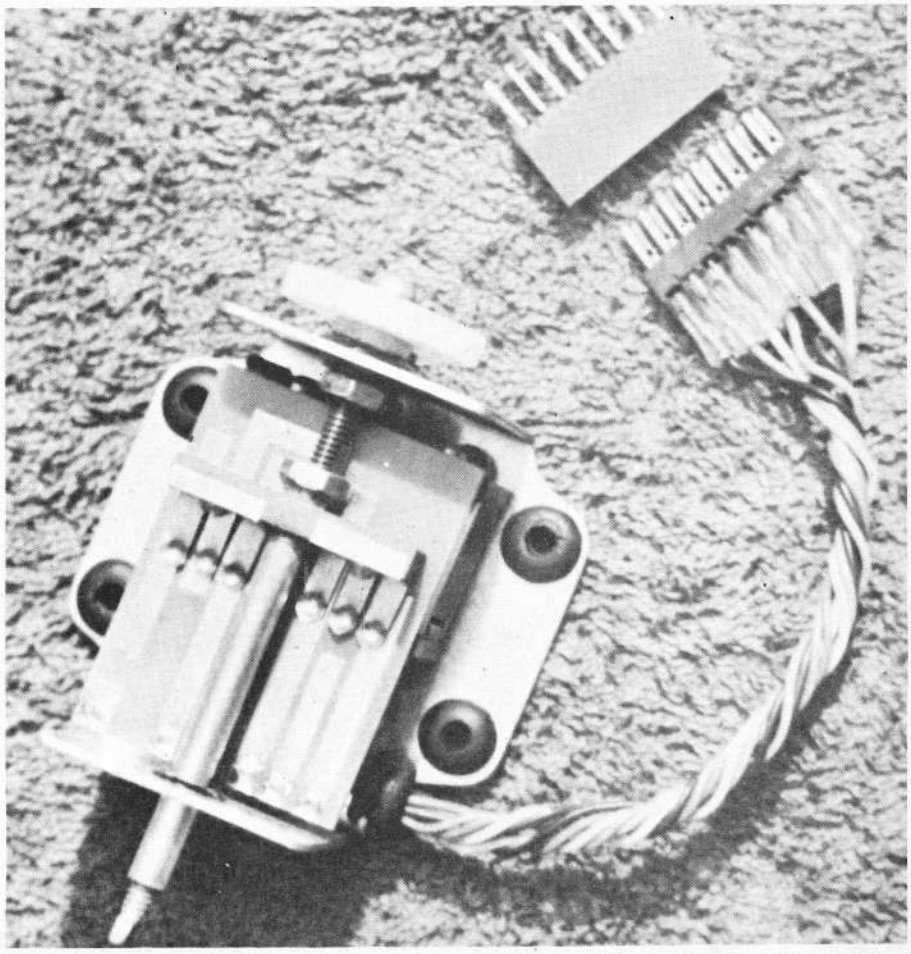
► Surveying the recent trends in the increasingly popular field of Multi, one finds miniaturization at the forefront. This article does not purport to present the ultimate on the subject, merely consider one answer to the servo problem and actually is only a starting point. Though one can go to extremes, at the present time the optimum size model seems to be one with about a four-foot span. For obvious reasons, this size is cheaper, easier to build and transport than the six footers and yet it has good visibility, is not fragile and does not present serious space problems.

It was with the four-foot model in mind that the authors began development of various servo-designs in an effort to provide a more compact unit. Reliability was of utmost importance, which dictated a simple, tried and proven layout and top grade components. The Bonner motor, due to its size and attractive construction features, was a natural for the purpose. The power output was found to be more than adequate and as a result, these servos have flown in everything from Esquires to Orions and Astros.

No attempt will be made to insult anyone's intelligence by giving a blow by blow description of the construction since the plans are quite clear; however, a construction sequence is suggested and a few dark corners will be enlightened.

If more than one servo is to be made, you'll find that a couple of form blocks for the base and dust cover will save a lot of time and yield identical components; these may be made of phenolic, aluminum or maple. Bend the end tab on the gear end of the base first, screw the motor to the base and locate the bearing hole in the end by meshing the gears with a little clearance marking through the hole in the big gear.

Several types of bearings were tried but the eyelet type presented is the simplest and easiest to duplicate. Drill out the end tab to 3/16" and then hand-ream to give a slightly sloppy fit to a 3/16" eyelet. The next operation is a little tricky but after the first one you'll be a pro. The eyelet is cut and filed so that about 1/16" protrudes and then it is swaged out to give a good fit with the 3/16" shaft bushing. (Swaging is done with a large taper pin or the shank of a center punch.) After this operation the eyelet is flared and set in the usual manner; the output end tab is bent up and the 5/32" eyelet installed in like fashion. The shaft bushing is a length of 3/16" thick wall steel, brass or hard aluminum tubing. We used standard spacers drilled or tapped for the 4-40 screw, though it may be fabricated by telescoping lengths of brass tubing. File the end of the (*Continued on page* 58)



Linear action is achieved through the use of a lead screw driven by a pinion and spur gear, torque is sufficient to operate the largest control surfaces and any of the engine throttles.

Super Tailwind

(*Continued from page* 16)

you have to sand a good deal but the result is lighter, I think. The original ship is painted with DuLux Vermilian by Dupont with light gray struts, gear legs, instrument panel, carpet, and registration numbers. The upholstery is of red leather on seats and side panels. When the paint job is done to your satisfaction, the cabin interior we spoke of can be completed.

The carpet is cut from Pellon material and glued on floor then painted gray. Make and set in rudder pedals, brake cylinders, control column, and flap lever. A good imitation leather is the adhesive backed plastic called Contax. This material can be cut to shape and then peeled off its backing and applied to any surface. It is very effective for trimming and seat covers.

Cut the windshield from a piece of .025" thick clear plastic sheet wide enough to fit fuselage width plus 1/16" and long enough to cover from cowl to top center of fuselage. Set up the contour of each side and center windshield support to the curve shown on side view. These are made from .040" aluminum wire. Cut out the foreward side windows to shape of the wire and even with door cutout. Cement in place carefully on the outside of fuselage avoiding excess cement so not to damage painted surfaces. Complete fitting of front windshield by trimming upper end to fit between F-10 side pieces and rest on top of F-8 tongue doubler below the surface of wing as shown in side view. Also be careful with the cement when putting this one on. Cut out and install the windows on the doors cementing inside to the 1/32" ply frame.

Now, all that's left is to install the tank. A small 1 oz. or 1-1/2 oz. size tank is plenty large enough. Attach it to the face of F-1 on right hand side. Filling is easy through the removable hatch section. Now check out the balance with every thing in place and add only the smallest amount of weight possible if you do need it. And now to the fun part.

Flying this jewel is a real thrill. With the balance checked out to the location shown, try a few test glides into some tall grass. Don't give up now, get up some speed (running is good) and let her try out those wings. This ship is fast and will settle fast if not given sufficient foreward speed to support its weight. When the glide is set, using the elevators for adjustment, you are ready for power tests. Using about 3 degrees of down thrust and 3 degrees right thrust and a 8 x 3-1/2" pitch prop set out for the best and smoothest runway you can fly from. With the power at about 2/3 on, start her heading into the wind. You may get a long taxi run, if so, reduce the down thrust about a third at the most and try her again. You will soon have her in the air with lots of fun doing it. Good flying and high points in your next flying scale contest.

Mini Multi Servo

(*Continued from page* 21)

bushing to remove excess slop in the bearing assembly. The nylon gears are attached to the bushing and major shaft with contact cement. If you feel that contact cement is inadequate at this point, a small amount of solder may be melted on the motor shaft and then filed into a projecting key; a needle file is then used to cut a mating key way in the gear.

The output shaft poses no problem though care should be taken to properly align the drive nut before soldering to the tubing. One good method is to run the nut up to the head of a 4-40x1/12 screw and slip the screw into the tube while soldering. The wiper bar is attached to the shaft with contact cement.

The contact board is easily fabricated by cutting to size and laying out the strips on the copper with a pencil. Locate the center of the strips from the wiper contacts and scribe their outline with a straight edge and an x-acto knife. It is not necessary to cut through the copper, just scribe it deeply and peel the unwanted portion off with the x-acto knife. Sand the board lightly with fine sandpaper to brighten it and remove any rough edges and drill the wire holes with a #6 drill. Assign a color code to your wires, (we used the one printed on duramite servos), and solder the wires before attaching the board to the top of the motor. Smooth off any flashing on the motor with a sanding block before attaching the contact board with contact cement.

Give the wipers a bit of care in fabrication since the reliability depends largely on their functioning properly. The spherical radius is important since it lets the wipers run smoothly over the edges of the copper printed circuit and concentrates the wiper pressure. We made a special tool for this by putting a spherical radius on a broken drill shank but careful use of a dull center punch will yield the same results.

After completion of the servo but before the trials, check the centering to make sure that both neutral wipers are not making contact at neutral. Trimming a slight bit off either contact will cure this condition or allow you to "open up" the neutral for those who desire to have a little trim here. If you prefer a more substantial hold down for the dust cover, #2 self tap screws may be added through the cover into the base end tabs. An alternate method here is to put small spherical indentions in the cover which mate with holes in the base ends to allow the cover to snap in place. In any case, accessibility is simple and a periodic cleaning of the wipers and board with a pipe cleaner and lighter fluid will make servo problems practically nonexistent.

As stated before, this is only a starting point. This combination has been highly successful for us but there are many variations of possible layout utilizing the same basic components and principle. A relayless version is possible by extending the length approximately ½ inch and mounting the circuit board vertically against the end tab; several circuits for this purpose are in "Grid Leaks" and other RC publications. All commercial components for the basic servo are available from Ace Radio Control, Box 301, Higginsville, Mo.

LIST OF MATERIALS

1—⅛" O.D. brass tube, ¼" long
1—5/32" O.D. brass tube, 1⅝" long

1—4-40 machine screw, 1½" or 1¾" long
1—4-40 machine screw, ½" long
2—4-40 nuts
2—1-72 machine screw, ⅛" long (HO train parts)
1—⅛" phenolic 1"x9/32"
1—3/16" dia. eyelet
1—5/32" dia. eyelet
.040 half hard alum. frame mat'l
.020 half hard alum. cover mat'l
1—1/16" P.C. board mat'l 1½"x1⅛"
1—Bonner motor
Bonner hook up wire
.006 Phosphor bronze
5—5/16" rubber grommets
4—#2 self tap screws
1—¾" nylon gear
1—3/16" nylon gear